

Project Justification

Anderson-Cottonwood Irrigation District Main Canal Lining Project

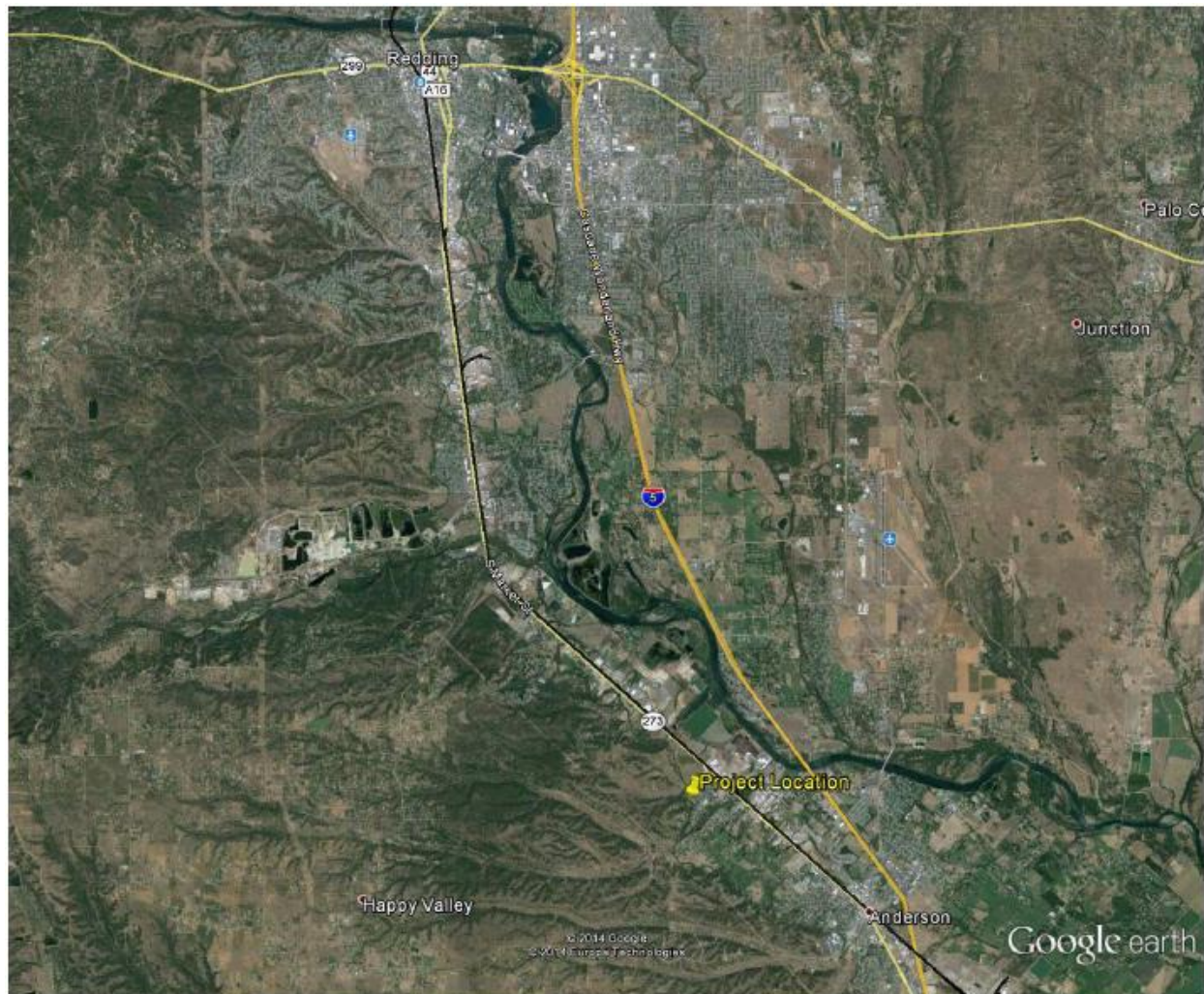
Table 4 – 2014 IRWM Drought Solicitation Project Summary Table

Drought Project Element		Project Name/ID Add 1 column per Project
D.1	Provide immediate regional drought preparedness	X
D.2	Increase local water supply reliability and the delivery of safe drinking water	
D.3	Assist water suppliers and regions to implement conservation programs and measures that are not locally cost-effective	X
D.4	Reduce water quality conflicts or ecosystem conflicts created by the drought	X
IRWM Project Element		
IR.1	Water supply reliability, water conservation, and water use efficiency	X
IR.2	Stormwater capture, storage, clean-up, treatment, and management	
IR.3	Removal of invasive non-native species, the creation and enhancement of wetlands, and the acquisition, protection, and restoration of open space and watershed lands	
IR.4	Non-point source pollution reduction, management, and monitoring	X
IR.5	Groundwater recharge and management projects	
IR.6	Contaminant and salt removal through reclamation, desalting, and other treatment technologies and conveyance of reclaimed water for distribution to users	
IR.7	Water banking, exchange, reclamation, and improvement of water quality	
IR.8	Planning and implementation of multipurpose flood management programs	
IR.9	Watershed protection and management	
IR.10	Drinking water treatment and distribution	
IR.11	Ecosystem and fisheries restoration and protection	

Project Description

This project will consist of the lining of a reach of earthen canal to reduce or eliminate seepage losses.

Project Location



Project Detail



Project Physical Benefits

Table 5 - Annual Project Physical Benefits			
Project Name: Northern Sacramento Valley Anderson-Cottonwood Irrigation District Main Canal Lining Project			
Type of Benefit Claimed: Amount of water supply saved			
Units of the Benefit Claimed : Acre feet			
Additional Information About this Benefit: Water saved would be available for use by agricultural irrigators.			
(a)	(b)	(c)	(d)
Physical Benefits			
Years of Project Life	Without Project	With Project	Change Resulting from Project (c) – (b)
30	0	26,730	26,730
Comments:			

Technical Analysis of Physical Benefits Claimed

The physical benefits resulting from this project are both related to conserved water currently lost after its diversion into the District's conveyance system during irrigation operations. The primary benefit is the amount of water supply saved, and a secondary benefit is the amount of flow saved for environmental purposes.

During a drought year with reduced supply and mandatory water conservation such as 2014, the volume of water that may be diverted into the main canal for delivery to growers is restricted by the curtailment imposed by Reclamation. The loss of water due to seepage at the project location directly impacts the availability of water to District growers; rescheduling of the District's monthly supply has eliminated almost all of the water available in October, and it is clear that there will be inadequate supply in September.

In years subsequent to project implementation, it is expected that water conserved by the project will result in a proportional reduction to annual diversions by the District. These reduced diversions will leave additional water in storage which will enhance the water supply and timing of releases to the Sacramento River for instream environmental purposes including temperature control, water quality, and Delta outflow requirements.

- Technical basis of the project and historical conditions

This project is relatively straightforward and consists of lining a reach of canal approximately 400 feet in length. Project development included work agreements with an environmental consultant and an engineering/construction contractor.

The engineering/construction contractor is RTA Construction, Inc. which will hereafter be referred to as RTA. The environmental consultant is VESTRA Resources, Inc., hereafter referred to as VESTRA.

In April 2014, significant seepage sheet flows developed on the downslope lands to the east of the main canal, representing significant water loss to the District and significant physical impacts to residents of the Verde Vale subdivision. The District contracted with RTA to implement a short-term solution to bring this seepage under control. Simultaneously, the District began working with the Shasta County Public Works

Department to facilitate re-establishment of an existing drain within Verde Vale to remove surface water from the subdivision.

An emergency response was developed that included the following (these activities occurred between late April and mid-May, 2014):

- Installation of two well points with pumps to capture and remove surface water adjacent to the canal.
- With the assistance and cooperation of the Verde Vale residents and Shasta County Public Works, District staff re-established the existing drain across the subdivision that facilitated the drainage of pooled sheet flows.
- Collection of existing geologic data to assist with seepage analysis.
- Collection and analysis of core samples from the east canal bank using a drilling rig. Samples were collected within the project area at six locations 100 feet apart to establish a profile of the underground strata. Samples were acquired at each of the six locations at five-foot vertical intervals, from five to 40 feet in depth.
- Comparison of existing geologic data with newly-acquired data to evaluate findings.
- Installation of two additional well points and deepening an earlier well point to facilitate the capture and removal of seepage water. Based on the geologic data acquired earlier, it was determined that an alluvial deposit underlies the canal and the Verde Vale subdivision at a depth of approximately 15 to 30 feet below the top of the canal bank. This deposit was identified as the conductor for seepage losses, which were exacerbated by the drying and shrinking of clay-bearing materials within the canal profile during the prolonged drought. Using the core sample data as guidance, perforated well casings were installed within drain rock to depths of approximately 20 feet, and submersible pumps installed to capture water being conducted away from the canal profile within the alluvial deposit.
- These efforts successfully removed all surface sheet flows adjacent to the canal within one week, although seepage that did not surface, and was below the pumps, continued to flow.

Technical data that was utilized for project development is attached, and includes the following:

1. Core samples and soil analysis (Mid Pacific Engineering, Inc. 2014)
2. Technical Memorandum (CH2M HILL 2007); Pit logs and soil gradations, Nut Tree Lane and Spring Gulch. This data is the basis for the report referenced in Item 3, below.
3. Page 4-1, Seepage Analysis; ACID Main Canal Modernization Project, Predesign Draft Report (CH2M HILL 2008); quantifies seepage at upstream locations.
4. An unsolicited Technical Memorandum 2014 submitted by Andy Lindeman, whose background is in Civil Engineering and who has worked in the environmental consulting industry.
5. NRCS Custom Soil Resource Report 2014 for the project area, specifically pages 8-10 and 16-17.

- Estimates of without-project conditions

The levels of the physical benefits in the future, without the project but with other projects that might be planned, are currently estimated to be zero. This project is specific to the project location; that is, a reach of earthen canal approximately 400 feet in length is experiencing significant seepage. This project would line the affected reach of canal to eliminate seepage; any other project that might be planned is not applicable to the problem and location described in this document, and would not affect or provide any physical benefits at this specific location.

- Description of methods used to estimate physical benefits

The technical data described above, including core samples and soil analyses conducted at the project site in 2014 and at upstream locations in 2007, were used to estimate physical benefits. The analysis completed in 2008 included the use of hydrogeologic modeling conducted by geologists at CH2M HILL. Three locations were analyzed in 2007, and the canal reach (upstream of the project site) with the greatest seepage losses at that time totaled losses of 595 acre feet per year per 1,000 linear feet of canal, assuming a total of 180 days of operation (equal to 238 acre feet per 400 linear feet of canal).

Physical observations of the seepage in April and May 2014 revealed an unprecedented volume of flow outside the canal profile resulting from seepage. Seepage at the upstream sites that were investigated in 2007 was also observed by District staff, and the comparative losses were much greater at the project site in 2014.

During the emergency response in April and May 2014, the District installed a total of four well points with five pumps to intercept and remove seepage outside the canal profile. The pump sizes and capacities were as follows:

1. (2) Three-inch pumps with a combined capacity of 600 gallons per minute (gpm).
2. (3) Two-inch pumps with a combined capacity of 150 gpm.

In addition, District staff re-established a surface drain within the Verde Vale subdivision to collect and remove surface sheet flows; this drain was estimated to be running at 100 gpm.

Based on the depth of the alluvial deposits beneath the canal profile, it was also estimated that additional seepage was migrating underground and not surfacing at the project location, but either percolating to groundwater or migrating to a downslope location. These losses, based on the soil technical data and depth of the 2014 core sample drillings, are estimated to be one-third of the visible seepage described above, or 285 gpm.

The total estimated seepage flow for the 400-foot reach of canal within the project area is 1,135 gpm ($600 + 150 + 100 + 285$ gpm), or 2.5 cubic feet per second. If such losses occurred for the entire 180 days of seasonal canal operation, the total volume lost would equal 891 acre feet of water.

It is assumed that lining the 400-foot reach of canal within the project area would eliminate these losses, resulting in a physical benefit of 891 acre feet of saved water.

In addition to saving water that would then be available for its intended use of agricultural irrigation, this saved water would reduce overall District diversions and leave an equal amount in storage. Increased storage would enhance the timing and flexibility of releases from Lake Shasta for instream environmental purposes.

- Identification of all new facilities, policies, and actions required to obtain the physical benefits

To obtain the physical benefits of the project, it will be necessary to implement construction activities for the purpose of installing a liner within the canal profile for a distance of approximately 400 linear feet. Preliminary design calls for fiber-reinforced concrete which will be applied within the canal profile following mechanical grubbing and shaping of the canal and banks. No other facilities, policies, or actions are anticipated.

- Description of any potential adverse physical effects

A potential effect of the project that might be considered adverse will be the change to the ecological environment of the canal and its banks. To install lining it will be necessary to clear the banks of the canal of all vegetation, resulting in a reduction of biomass and a potential impact to the aesthetics and riparian value of the site. The east bank of the canal is currently clear of any trees or other permanent vegetation, and no impact will result from the project. The west bank of the project site is characterized by non-native vegetation including Himalayan blackberry; native grasses; and four or five large gray pine, all of which will be removed. The District has contracted with an environmental consultant to conduct an Initial Study and Environmental Assessment and to comply with all permitting requirements. Any necessary mitigation will be developed within the environmental and permitting processes.

Table 6 – Cost Effective Analysis**Project name: Northern Sacramento Valley Anderson-Cottonwood Irrigation District Main Canal Lining Project**

Question 1	Types of benefits provided as shown in Table 5: (1) Amount of water supply saved; and, (2) Amount of environmental flow provided.
Question 2	Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified? Yes.
	If no, why?
	If yes, list the methods (including the proposed project) and estimated costs. The proposed project method is to line an earthen canal, which is the least cost alternative, with fiber-reinforced concrete (estimated cost: \$240,000). An alternative to lining is piping, but anticipated costs to pipe 400 linear feet of canal for 319 cubic feet per second capacity is prohibitive; as such, cost estimates for piping were not developed but would likely exceed \$1million. In addition, various products of varying cost were considered for lining. These include: fiber-reinforced concrete (\$2.50/sq. ft.); geomembrane materials (\$2.00/sq. ft.); bentonite (\$3.00/sq. ft.); concrete blanket (\$6.00/sq. ft.).
Question 3	If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods. Lining the canal is the least cost alternative. The use of fiber-reinforced concrete is the preferred product for lining; using an alternative lining material such as geomembrane materials would be of nominally lower cost. However, the durability and life-span of geomembrane is much less than concrete liners, so, while less expensive at implementation, would not be as cost effective over the long term. In addition, the location is not conducive to the use of geomembrane materials because of the likelihood of falling limbs and animal traffic (deer) puncturing the liner. Concrete liner is much more durable, impervious to ultraviolet rays from the sun, and requires much less maintenance than geomembrane.
Comments:	